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Original Article

Laparoendoscopic single-site myomectomy using conventional laparoscopic instruments and glove port technique: Four years experience in 109 cases

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ABSTRACT

Objective: To report a single surgeon's experience with 109 laparoendoscopic single-site myomectomy (LESS-M) using conventional laparoscopic instruments and a homemade glove port system.
Materials and methods: A total of 109 consecutive women who underwent LESS-M between March 2011 and April 2015 were reviewed.
Results: The mean age and body mass index were 38.3 ± 6.5 years and 22.1 ± 3.0 kg/m^2. The mean diameter of the largest myoma and the mean number of myomas were 8.1 ± 2.4 cm and 1.6 ± 0.7. The mean weight of the myomas was 223.2 ± 159.7 g. The most common type of myoma was intramural (61%), followed by subserosal (23%), submucosal (9%), and intraligamental (7%). The most common site of the myomas was anterior (39%), followed by posterior (38%), lateral (15%), and fundal (9%). The mean operative time and estimated blood loss were 138.5 ± 43.8 min and 104.9 ± 270.1 mL. Two patients (1.8%) required intraoperative transfusion. The mean hospital stay was 2.5 ± 0.6days. There were no conversions to laparotomy, but three patients(2.8%) were converted to two-port laparoscopic myomectomy. No patient experienced any major complication, including bowel, ureter, bladder injuries, or incisional hernia. Six women became pregnant after the operation, and five of these patients delivered their babies at full term by cesarean section. One patient delivered her baby at a gestational age at 32 weeks due to idiopathic polyhydramnios by cesarean section. One patient had the second pregnancy and delivery after LESS-M. Fourteen patients (12.8%) had small recurrent myomas that did not require treatment.
Conclusion: LESS-M is a feasible alternative for patients with symptomatic myomas, and this technique can provide cosmetic advantages compared to conventional laparoscopic surgery.

Introduction

With technical improvements and increasing experience, surgeons are decreasing the number of abdominal incisions and visible scars. Laparoendoscopic single-site surgery (LESS) is a new technique for hysterectomy, adnexal surgery, and myomectomy with a small amount of scarring and good cosmetic results. Decreased postoperative pain and analgesia requirements have also been reported in patients receiving LESS compared to conventional laparoscopic surgery [1,2]. However, LESS is not widely available because of the technical difficulty of the procedure, including reduced visualization, loss of triangulation and instrument interference [3,4]. Laparoendoscopic single-site myomectomy (LESS-M) is more difficult than other surgical techniques because it requires extensive suturing and knot tying, as well as extraction of relatively large tissue specimens through the umbilicus. A homemade glove port laparoscopic system has been reported to decrease trocar collisions with no additional cost to the use of conventional laparoscopic instruments [5,6].

A few articles describing the LESS-M technique were published in the late 2010s [7,8]. The small number of published studies seems to be related to the technical difficulty of suturing and tying while performing LESS-M, thereby limiting its wide application [9–14]. However, these studies showed the feasibility and safety of LESS-M with small case series. In addition, there is a lack of data on

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obstetric outcomes. In this study, we evaluated the operative outcomes of 109 cases of LESS-M using a homemade glove port laparoscopic system to decrease trocar collisions, and to suture the myometrial wound by extracorporeal tying with a knot pusher to overcome the difficulty of intracorporeal suture tying. In addition, we report the pregnancy and obstetric outcomes of six patients.

Materials and methods

Subjects

Between September 2011 and April 2015, we recruited 109 consecutive patients with uterine myomas who were initially scheduled to undergo LESS-M, performed by a single surgeon (SYC) with 10 years of experience in multiport laparoscopic surgery, at Cathy General Hospital in Taiwan. Before the procedure, all patients were fully informed of the characteristics of the operation and the possibility of requiring conversion to an open procedure or conventional laparoscopic surgery. All patients signed written consent form. The IRB approval was obtained from the Cathy General Hospital. Exclusion criteria for the minimally invasive approach were the same as for traditional laparoscopic surgery. Women with a history of severe adhesions or suspected gynecologic malignancy underwent laparotomy.

Laparoscopic techniques

Laparoscopy was performed under general anesthesia with endotracheal intubation. The participants were placed in the Trendelenburg position for the procedure. A Foley catheter was inserted into the bladder and kept in place for 24 h. A uterine manipulator was fixed to allow for uterine movement in women with sexually active.

The glove port laparoscopic technique was performed as previously reported [5,7]. Briefly, a single 1.7-cm longitudinal umbilical skin incision was made. The entry into the peritoneal cavity and incision in the fascia were extended using small Kelly forceps, enabling 2-cm access to the abdomen without extending the skin incision. To prepare the glove port system, an Alexis wound retractor (Applied Medical, Rancho Santa Margarita, CA) was inserted transumbilically, and the outer rim was draped with a No. 7 surgical rubber glove. Three 5-mm trocars were inserted into three fingers of the glove and sealed with 3M™ tape (Fig. 1A). CO_2 was insufflated through the side hole of a 5-mm trocar to maintain an intra-abdominal pressure of 12 mmHg. The surgical instruments used for the procedure were rigid 5-mm, 0-degree laparoscopes, standard rigid atraumatic forceps, toothed grasper, myoma screw, scissors, laparoscopic needle holder, suction-irrigation system, and electrosurgical Ligasure system (Dolphin Tip 37 cm Laparoscopic Instrument, LS1500) (Covidien,Valleylab, Boulder, CO, USA). The surgeon stood on the left side of the patient, and an assistant surgeon stood on the right side of the patient and manipulated the rigid scope through the 5-mm umbilical port with their left hand.

LESS-M was performed after the injection of 30–50 mL diluted vasopressin (Pitressin, Pfizer, Karlsruhe, Germany) (20 U/mL diluted in 100 mL saline) into the myoma bed. A transverse incision was made in the myometrium using dolphin-nose tip Ligasure (Fig. 1B) and deepened until the myoma surface appeared. Myoma enucleation was performed with traction using a 5-mm myoma screw or claw forceps, and the capsule was separated from the myoma using Ligasure (Fig. 1C).

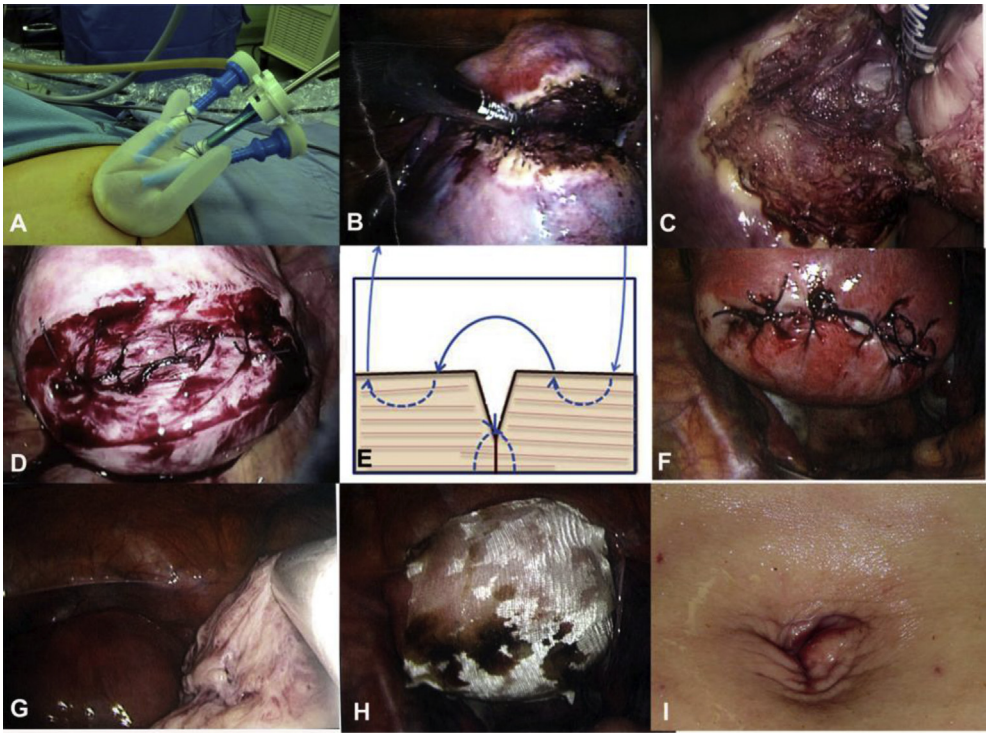

Fig. 1. A. Ports were positioned as shown. The laparoscope was inserted through a 5-mm port with CO_2 insufflated through the side hole of a 5-mm trocar. **B.** A transverse incision was made on the myometrium using a dolphin-nose tip Ligasure and deepened until the myoma surface appeared. **C.** Myoma enucleation was performed by traction with a 5-mm myoma screw or claw forceps, and the capsule was separated from the myoma by Ligasure. **D.** The myometrial wound was repaired with two layers of interrupted extracorporeal sutures using a conventional knot pusher. **E, F.** The outer layer was sutured using the technique proposed by Keckstein. **G.** Enucleated myomas were extracted through the umbilical incision using a 12-mm electromechanical morcellator. **H.** After meticulous hemostasis and thorough wound cleansing, an adhesion barrier was applied. **I.** The skin was sealed with DERMABOND® Mini Topical Skin Adhesive.

The myometrial wound was repaired with two layers of interrupted extracorporeal sutures using 1-0 polyglactin 9467 suture (Vicryl®; Ethicon Inc.) using a conventional knot pusher (Fig. 1D). The outer layer was sutured using the technique proposed by Keckstein [15] (Fig. 1E and F). Enucleated myomas were extracted through the umbilical incision using a 12-mm electromechanical morcellator (Gynecare, Ethicon Inc., Somerville, NJ, USA), which was inserted through one free finger of the surgical glove without a trocar and sealed using 3M™ tape (Fig. 1G), [16]. After meticulous hemostasis and thorough wound cleansing, an adhesion barrier (Interceed; Ethicon Inc.) was applied (Fig. 1H).

The peritoneum and fascial layers of the umbilical wound were simultaneously closed with a Z suture using No. 2 Polysorb (glycolide-lactide copolymer) 5/8 circle (Covidien PLC, Dublin, Ireland). The skin was sealed with DERMABOND® Mini Topical Skin Adhesive (Ethicon Inc.) (Fig. 1I). The operative time was defined as the interval between the initial skin incision to closure. Blood loss was calculated as the amount of aspirated fluid in the bottle. Pelvic lavage was performed using normal saline solution after the myoma wound had been closed before applying the Interceed barrier. The removed myomas were weighed before being fixed in formalin. Complications were defined as events requiring active treatment or a prolonged hospital stay.

Evaluation parameters

The flowing parameters were recorded: operative outcomes such as the number, size, and weight of the myomas, operative time, estimated operative blood loss and complications such as blood transfusion, wound infection, and hematoma. At 6, 12, 18, 24, and 36 months after surgery, all of the patients were evaluated to check for the recurrence of myomas by transvaginal ultrasound or transabdominal ultrasound for patients with no sexual experience.

Statistics

SPSS software version 12.0 for Windows (SPSS Inc., Chicago, IL, USA) was used for all statistical analyses. Descriptive statistics were presented as means ± SD or percentages.

Results

A total of 109 patients were enrolled in this study, and their general characteristics and operative findings are listed in Table 1. The mean age and body mass index were 38.3 ± 6.5 years and 22.1 ± 3.0 kg/m^2, respectively. The mean diameter of the largest myoma and the mean number of myomas were 8.1 ± 2.4 (range, 4–14) cm and 1.6 ± 0.7 (range, 1–3), respectively. The mean weight of the myomas was 223.2 ± 159.7 (range, 13–760) g. The most common type of myoma was intramural (61%, 66/109), followed by subserosal (23%, 25/109), submucosal (9%, 10/109), and intraligamental (7%, 8/109). The most common location of the myoma was anterior (39%, 42/109), followed by posterior (38%, 41/109), lateral (15%, 16/109), and fundal (9%, 10/109). The mean operative time and estimated blood loss were 138.5 ± 43.8 min and 104.9 ± 270.1 mL, respectively. Two patients (1.8%) required intraoperative transfusions. The mean hospital stay after the operation was 2.5 ± 0.6 days. Conversion to double port surgery (one more trocar inserted into the left lower abdominal site) was required in three patients (2.8%) because of severe pelvic adhesion. No patient experienced any major complication, including bowel, ureter, or bladder injuries, or incisional hernia. Fourteen patients (12.8%) had small recurrent myomas without the need for treatment. During the study period, no patient was lost to follow-up.

Table 1
Patients' characteristic and operative findings.

Patients	$N = 109$
Age (years)	30.9 ± 6.9 (12–45)
Body mass index (kg/m^2)	22.0 ± 4.8 (17.7–37.3)
Myoma type	
Intramural	66 (61%)
Subserosal	25 (23%)
Submucosal	10 (9%)
Intraligamental	8 (7%)
Myoma location	
Anterior	42 (39%)
Posterior	41 (38%)
Lateral	16 (15%)
Fundal	10 (9%)
Maximal diameter of myoma (cm)	8.1 ± 2.4 (range, 4–14)
Myoma number	1.6 ± 0.7 (range, 1–3)
Myoma weight (g)	223.2 ± 159.7 (range, 13–760)
Operative time (minutes)	138.5 ± 43.8 (range, 65–370)
Blood loss (mL)	104.9 ± 270.1 (range, 10–2400)
Postoperative hospital stay (day)	2.5 ± 0.6 (range, 1–3)
Recurrence	14 (12.8%)

Data are expressed as mean ± standard deviation (range) or as case number (n) (%).

Of the 109 women, six became pregnant after the operation (Table 2), and five of these patients delivered their babies at full term by cesarean section without any complications. One patient delivered her baby at a gestational age at 32 weeks due to idiopathic polyhydramnios by cesarean section. One patient had the second pregnancy and delivery after LESS-M. Fig. 2A and B shows the umbilical wound before and after DERMABOND® applied just after LESS-M. Fig. 2C and D shows the umbilical wound and uterine wound during cesarean section of one patient.

Discussion

LESS is not widely available because of the technical difficulty of the procedure [3,4], as well as the need for expensive instrumentation and greater surgical skill. Our results demonstrated that LESS-M is a safe and effective alternative to conventional laparoscopic myomectomy for a select group of patients with myomas with a maximum diameter of 13.9 cm. The homemade glove port laparoscopic system provided a flexible fulcrum and decreased trocar collisions, and did not incur any additional costs to the use of conventional laparoscopic instruments [5,6]. We were able to perform LESS-M using a conventional rigid straight laparoscope without serious crowding with three 5-mm trocars. There was also less crowding during transumbilical morcellation because only two instruments, a 5-mm laparoscope and a 12-mm morcellator, were inserted [7].

Many of the patients who undergo myomectomy are young women who wish to preserve their fertility, and the quality of the uterine suture is important during pregnancy. Laparoscopic suturing and knotting is technical difficult in LESS-M due to the narrow range of movement and the frequent clashing of instruments. Suturing with extracorporeal tying using a knot pusher overcomes the difficulty in intracorporeal suture tying in LESS-M [14,17]. It is important to manipulate the uterus to achieve a proper direction for suturing, and a uterine manipulator or traction of thread in the opposite direction to the myometrial defect can enable easy suturing [9]. In addition, a barbed suture can speed uterine closure because there is no need to tie knots, and this enables continuous wound closure [18]. Obstetric outcomes after LESS-M are an important issue. To diminish the risk of uterine rupture, we repaired the defect of the myometrium and serosa in two layers using 1-0 polyglactin 9467 (Vicryl) interrupted sutures with extracorporeal knots using a conventional knot pusher. In this

Table 2
Patients' pregnant outcome after LESS myomectomy.

case	Age (Y)	Time of conception (month)	Myoma size (cm)	Myoma No:	Myoma weight (g)	Myoma type	Myoma location	Gestational age (week)	Baby birth weight (g)
1	36	3	7.6	3	416	subserosal	anterior	38	2780
								38	2840
2	35	23	9.1	1	292	intramural	posterior	38	2740
3	26	29	8.3	1	233	intramural	anterior	32	1718
4	25	6	6	1	143	intramural	posterior	37	3160
5	35	16	7.7	1	174	intramural	anterior	37	2764
6	34	14	5	2	66	intramural	posterior	36	2503

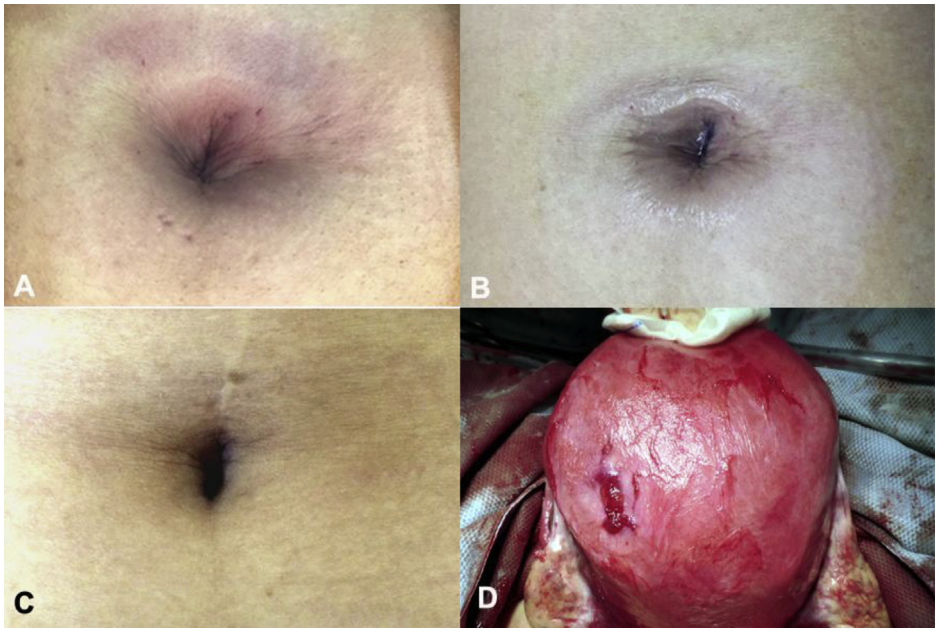

Fig. 2. Fig. 2A and B shows the umbilical wound before and after DERMABOND® applied just after LESS-M. Fig. 2C–D shows the umbilical wound and uterine wound during cesarean section.

study, six women became pregnant after the operation, and five of these patients delivered their babies at full term by cesarean section without any complications. One patient delivered her baby at a gestational age at 32 weeks due to idiopathic polyhydramnios by cesarean section. One patient had the second pregnancy and delivery after LESS-M.

There were no major complications, including bowel, ureter, or bladder injuries, or incisional hernia in this study. One patient lost 2400 mL of blood intraoperatively. This was the operator's fourth LESS-M procedure, and the patient was an actress with no history of sexual intercourse for whom the cosmetic outcome was very important. After 2000 mL of blood had been transfused, LESS-M was finally successfully for amyoma 13.9 cm in size and 760 g in weight. Three patients experienced severe adhesion and required a second 5-mm accessory port. Lee et al. reported that proficiency in performing LESS-M was achieved after about 45 operations [19], and suggested that simple procedures such as oophorectomy should be attempted first by surgeons inexperienced with LESS followed by cystectomy, hysterectomy, and finally myomectomy. Laparoscopic suturing through a single opening is the major technical limitation in LESS-M, and the type and location of the myoma may be more important than the size of the myoma [19]. In our experience, intraligamentary and pedunculated/subserosal myomas are suitable for LESS-M, because multiple sutures to repair deep myometrial defects may not be required. Of the intramural types, myomas located in the anterior wall of the uterus and located close to the fundus were more suitable for LESS-M, which is consistent with a previous study [19]. LESS-M is not LESS itself but myomectomy, and surgeons should not hesitate to convert from LESS-M to multiport laparoscopic myomectomy to achieve complete myomectomy if necessary [17].

There are several limitations to this study. Although it was prospective, it lacked long-term follow-up. In addition, all operations were performed by a single surgeon, which limits the generalization of the results. Although there were no cases of uterine rupture in the present study, further studies are needed to confirm this finding.

In conclusion, LESS-M is safe and acceptable for myomas at various locations and sizes up to 13.9 cm. Although LESS-M is a challenging surgical technique, the challenge can be overcome with greater experience, and appropriate equipment and suture methods.

Conflict of interest

The authors state that no potential or actual conflict of interest, whether of a financial or other nature, is involved in this submission.

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References

[1] Fagotti A, Bottoni C, Vizzielli G, Gueli Alletti S, Scambia G, Marana E, et al. Postoperative pain after conventional laparoscopy and laparoendoscopic single site surgery (LESS) for benign adnexal disease: a randomized trial. Fertil Steril 2011;96:255–9. e2.

[2] Chen YJ, Wang PH, Ocampo EJ, Twu NF, Yen MS, Chao KC. Single-port compared with conventional laparoscopic-assisted vaginal hysterectomy: a randomized controlled trial. Obstet Gynecol 2011;117:906–12.

[3] Ramirez PT. Single-port laparoscopic surgery: is a single incision the next frontier in minimally invasive gynecologic surgery? Gynecol Oncol 2009;114:143–4.

[4] Lee IO, Yoon JW, Chung D, Yim GW, Nam EJ, Kim S, et al. A comparison of clinical and surgical outcomes between laparo-endoscopic single-site surgery and traditional multiport laparoscopic surgery for adnexal tumors. Obstet Gynecol Sci 2014;57:386–92.

[5] Yang YS, Oh KY, Hur MH, Kim SY, Yim HS. Laparoendoscopic single-site surgery using conventional laparoscopic instruments and glove port technique in gynecology: a single surgeon's experience. J Minim Invasive Gynecol 2014;22:87–93.

[6] Yi SW. Two-port laparoscopic adnexal surgery with a multichannel port using a wound retractor: is it safe and minimally scarring? J Laparoendosc Adv Surg Tech A 2009;19:781–6.

[7] Kim YW, Park BJ, Ro DY, Kim TE. Single-port laparoscopic myomectomy using a new single-port transumbilical morcellation system: initial clinical study. J Minim Invasive Gynecol 2010;17:587–92.

[8] Lee JH, Choi JS, Jeon SW, Son CE, Lee SJ, Lee YS. Single-port laparoscopic myomectomy using transumbilical gelport access. Eur J Obstet Gynecol Reprod Biol 2010;153:81–4.

[9] Yoon A, Kim TJ, Lee YY, Choi CH, Lee JW, Bae DS, et al. Laparoendoscopic single-site (LESS) myomectomy: characteristics of the appropriate myoma. Eur J Obstet Gynecol Reprod Biol 2014;175:58–61.

[10] Choi CH, Kim TH, Kim SH, Choi JK, Park JY, Yoon A, et al. Surgical outcomes of a new approach to laparoscopic myomectomy: single-port and modified suture technique. J Minim Invasive Gynecol 2014;21:580–5.

[11] Han CM, Lee CL, Su H, Wu PJ, Wang CJ, Yen CF. Single-port laparoscopic myomectomy: initial operative experience and comparative outcome. Arch Gynecol Obstet 2012;287:295–300.

[12] Kang JH, Lee DH, Lee JH. Single-port laparoscopically assisted transumbilical ultraminilaparotomic myomectomy. J Minim Invasive Gynecol 2014;21:945–50.

[13] Yuk JS, Ji HY, Kim KH, Lee JH. Single-port laparoscopically assisted-transumbilical ultraminilaparotomic myomectomy (SPLA-TUM) versus single port laparoscopic myomectomy: a randomized controlled trial. Eur J Obstet Gynecol Reprod Biol 2015;188:83–7.

[14] Yoshiki N, Okawa T, Kubota T. Single-incision laparoscopic myomectomy with intracorporeal suturing. Fertil Steril 2011;95:2426–8.

[15] Keckstein J. Cirugia Laparoscopica en Ginecologia. In: Keckstein J, Hucke J, editors. Cirugia conservadora y miomas. Buenos Aires, Bogota, Caracas, Madrid, Mexico, Sao Paulo; 2003. p. 214–31.

[16] Kim SK, Lee JH, Lee JR, Suh CS, Kim SH. Laparoendoscopic single-site myomectomy versus conventional laparoscopic myomectomy: a comparison of surgical outcomes. J Minim Invasive Gynecol 2014;21:775–81.

[17] Kim JY, Kim KH, Choi JS, Lee JH. A prospective matched case-control study of laparoendoscopic single-site vs conventional laparoscopic myomectomy. J Minim Invasive Gynecol 2014;21:1036–40.

[18] Song T, Kim TJ, Kim WY, Lee SH. Comparison of barbed suture versus traditional suture in laparoendoscopic single-site myomectomy. Eur J Obstet Gynecol Reprod Biol 2015;185:99–102.

[19] Lee HJ, Kim JY, Kim SK, Lee JR, Suh CS, Kim SH. Learning curve analysis and surgical outcomes Of single-port laparoscopic myomectomy. J Minim Invasive Gynecol 2015;22:607–11.